



**UNIVERSITAS INDONESIA**  
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### MODULE HANDBOOK

Module designation	<i>Linear Algebra 1</i>
Semester(s) in which the module is taught	2
Person responsible for the module	<i>Dr. Denny R. Silaban</i>
Language	<i>Indonesia</i>
Relation to curriculum	<i>Compulsory</i> <i>The module is shared with the Statistics, Actuarial Science undergraduate study programs</i>
Teaching methods	<i>Flipped Class and Question based learning using E-learning</i>
Workload (incl. contact hours, self-study hours)	<i>Total workload: 170 minutes/credit point</i> <i>Contact hours: 50 minutes synchronous and 120 minutes asynchronous (independent study/reading, doing homework, discussion with peers, computer practice)</i>
Credit points	3 SKS (4.77 ECTS)
Required and recommended prerequisites for joining the module	<i>Elementary Linear Algebra</i>

Module objectives/intended learning outcomes	<p><i>After completing Elementary Linear Algebra courses, students are</i></p> <ol style="list-style-type: none"> <li>1. <i>able to apply the basic theories of mathematical thinking in Linear Algebra 1 (C4).</i></li> <li>2. <i>Able to identify the structure of vector space and subspace (C4).</i></li> <li>3. <i>Able to discover the basis and dimension of vector space (C4).</i></li> <li>4. <i>Able to correlate between linear system equations and vector spaces and their properties (C4).</i></li> <li>5. <i>Able to determine matrix transformation (C3).</i></li> <li>6. <i>Able to relate between the invertibility matrix transformation and transformation's properties (C3).</i></li> <li>7. <i>Able to calculate eigen value and basis of eigen spaces of a matrix (C3).</i></li> <li>8. <i>Able to identify the nature of inner product space (C3).</i></li> <li>9. <i>Able to compute orthonormal basis of a vector space using Gram-Schmidt process (C3).</i></li> <li>10. <i>Able to compute orthogonal diagonalization of symmetric matrices (C3).</i></li> <li>11. <i>Able to examine real quadratic function by using matrix methods (C3).</i></li> <li>12. <i>Able to identify general linear transformation and it's properties (C4)</i></li> <li>13. <i>Able to use Linear Algebra software or toolkits (C3)</i></li> </ol>
Content	<p><i>Real vector space, subspace, basis and dimension, change of basis, row space, column space, null space, rank and nullity, linear transformation and its properties, composition and inverse transformation, matrix for general linear transformation, eigen value and eigen vector, inner product space and orthogonality, Gram-Schmidt process, ortogonal diagonalization, quadratic form, similarity.</i></p>
Examination forms	<p><i>Essay, multiple choice</i></p>

<p>Study and examination requirements</p>	<p><i>The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:</i></p> <p> <i>Quiz</i> : 20 %  <i>Assignment (including computer assignment)</i> : 25 %  <i>Mid-test</i> : 25 %  <i>Final-test</i> : 30 %  <i>Total</i> : 100 % </p> <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;"><b>Mark</b></th> <th style="text-align: center;"><b>Grade</b></th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">85—100</td> <td style="text-align: center;">A</td> </tr> <tr> <td style="text-align: center;">80—&lt;85</td> <td style="text-align: center;">A-</td> </tr> <tr> <td style="text-align: center;">75—&lt;80</td> <td style="text-align: center;">B+</td> </tr> <tr> <td style="text-align: center;">70—&lt;75</td> <td style="text-align: center;">B</td> </tr> <tr> <td style="text-align: center;">65—&lt;70</td> <td style="text-align: center;">B-</td> </tr> <tr> <td style="text-align: center;">60—&lt;65</td> <td style="text-align: center;">C+</td> </tr> <tr> <td style="text-align: center;">55—&lt;60</td> <td style="text-align: center;">C</td> </tr> <tr> <td style="text-align: center;">40—&lt;55</td> <td style="text-align: center;">D</td> </tr> <tr> <td style="text-align: center;">&lt;40</td> <td style="text-align: center;">E</td> </tr> </tbody> </table>	<b>Mark</b>	<b>Grade</b>	85—100	A	80—<85	A-	75—<80	B+	70—<75	B	65—<70	B-	60—<65	C+	55—<60	C	40—<55	D	<40	E
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<p>Reading list</p>	<p>[1] Anton, Howard; Chris Rorres, <i>Elementary Linear Algebra: Applications Version</i>, 11<sup>th</sup> ed., Wiley 2014.</p> <p>[2] Strang, Gilbert, <i>Linear Algebra and Its Application</i>, 4<sup>th</sup> ed., Thomson Books/Cole, 2006.</p>																				